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(54) **Cavity Wall Fastener**

(57) A fastening element for enabling a screw threaded member to be secured to a wall element inaccessible from the rear such as a cavity wall. In order to enable the fastening to be used with a wide variety of wall materials without causing damage thereto, the fastening comprises an anchoring member (2) having a base (6) having an aperture (7) for receiving a screw-threaded member (3) and a plurality of supporting legs (5) extending axially and radially of the base (6), the legs being substantially rigid in the axial direction so as to bear against the wall element and being flexible radially inwards to enable the anchoring member to be passed through an aperture in the wall element. Preferably a bush (4), connected to the base (6) by at least one strand (17), is provided to centre the member (3) in the hole through the wall element.

Fig.1

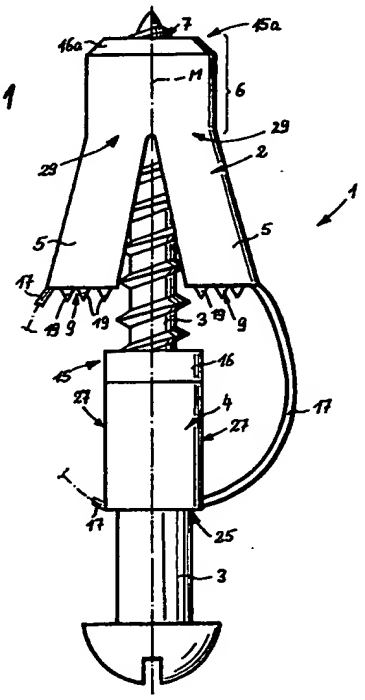

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Fig. 1

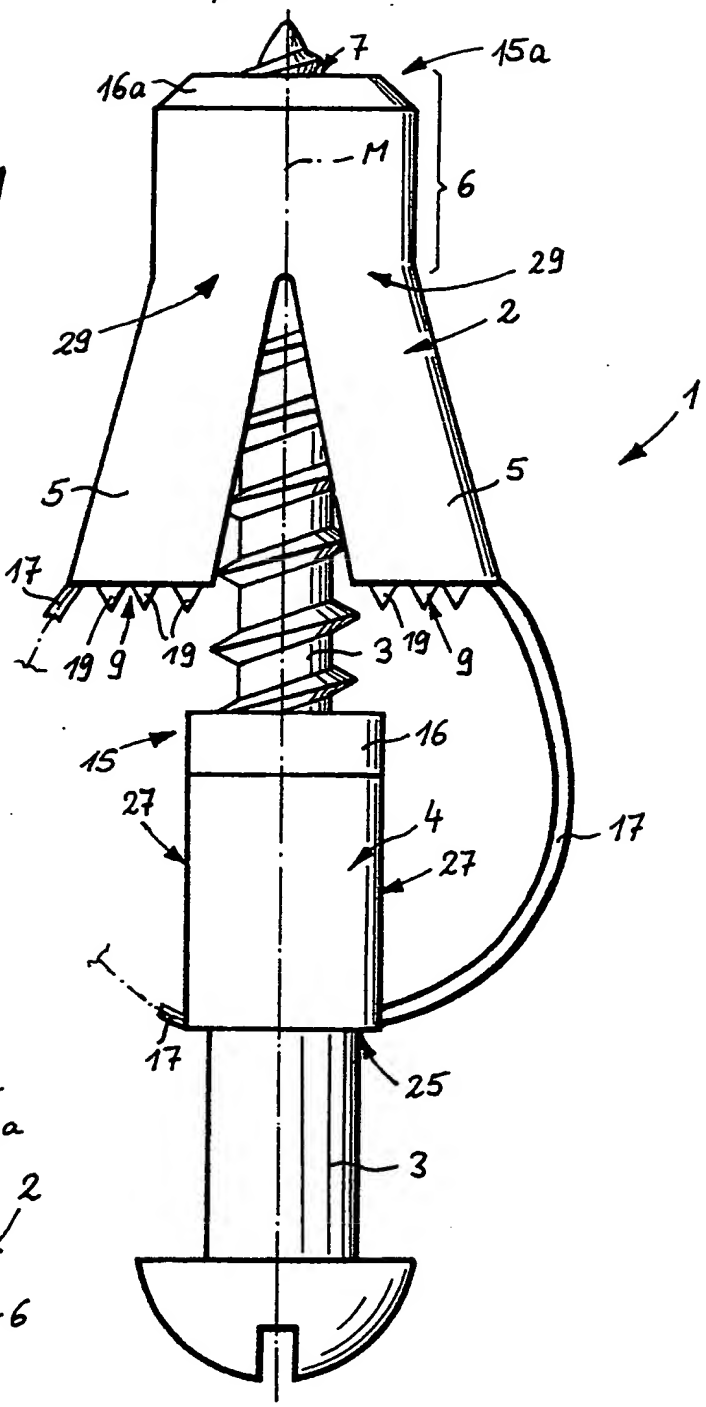
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Fig. 2

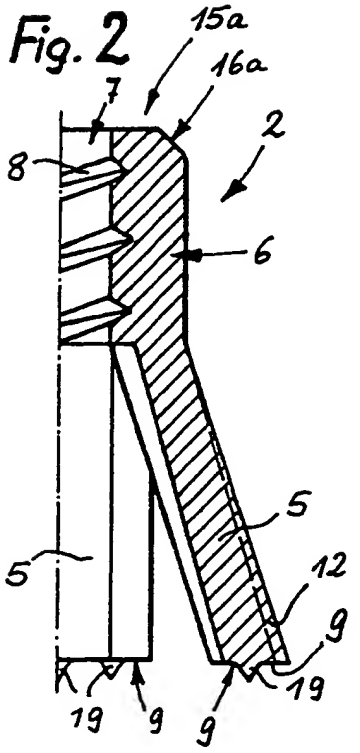
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Fig. 3

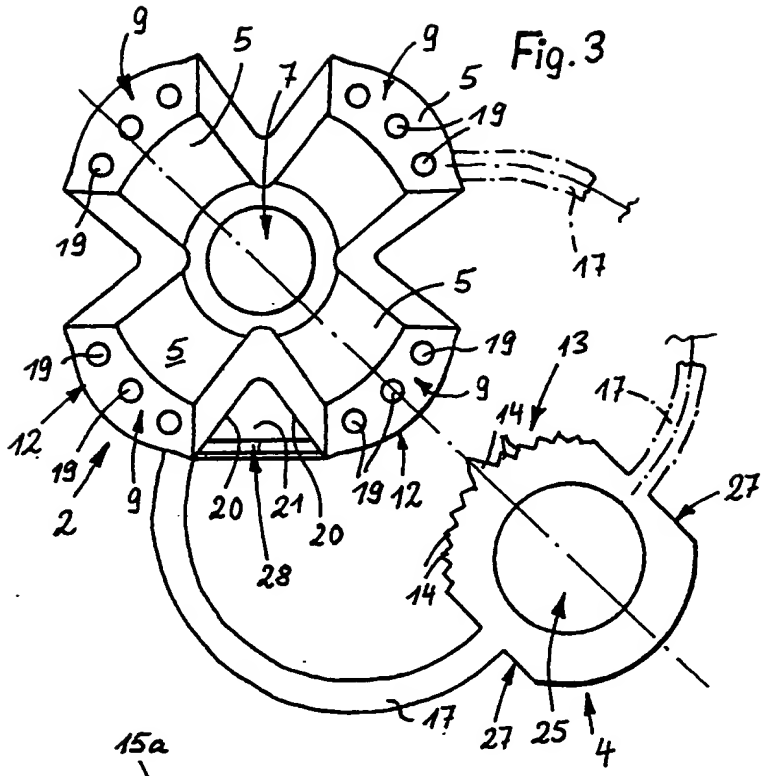
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Fig. 4

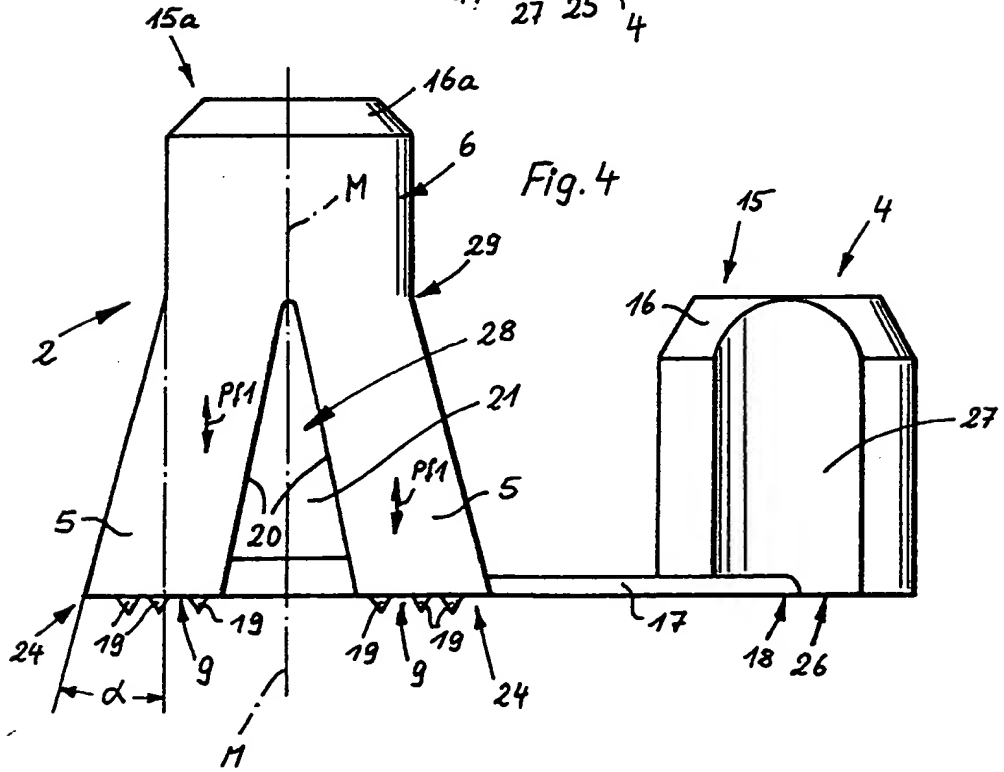
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Fig. 5

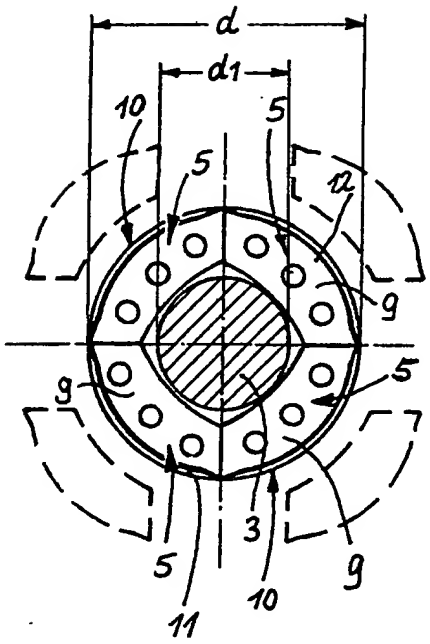


Fig. 6

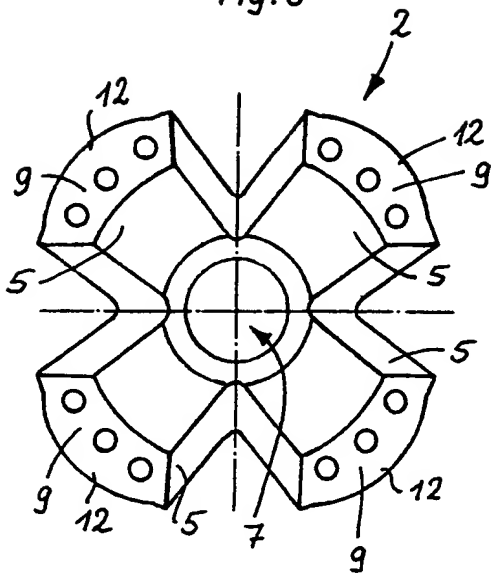
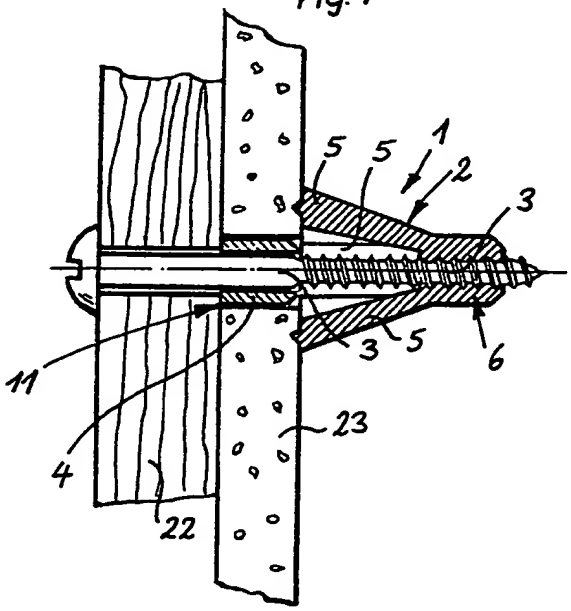


Fig. 7



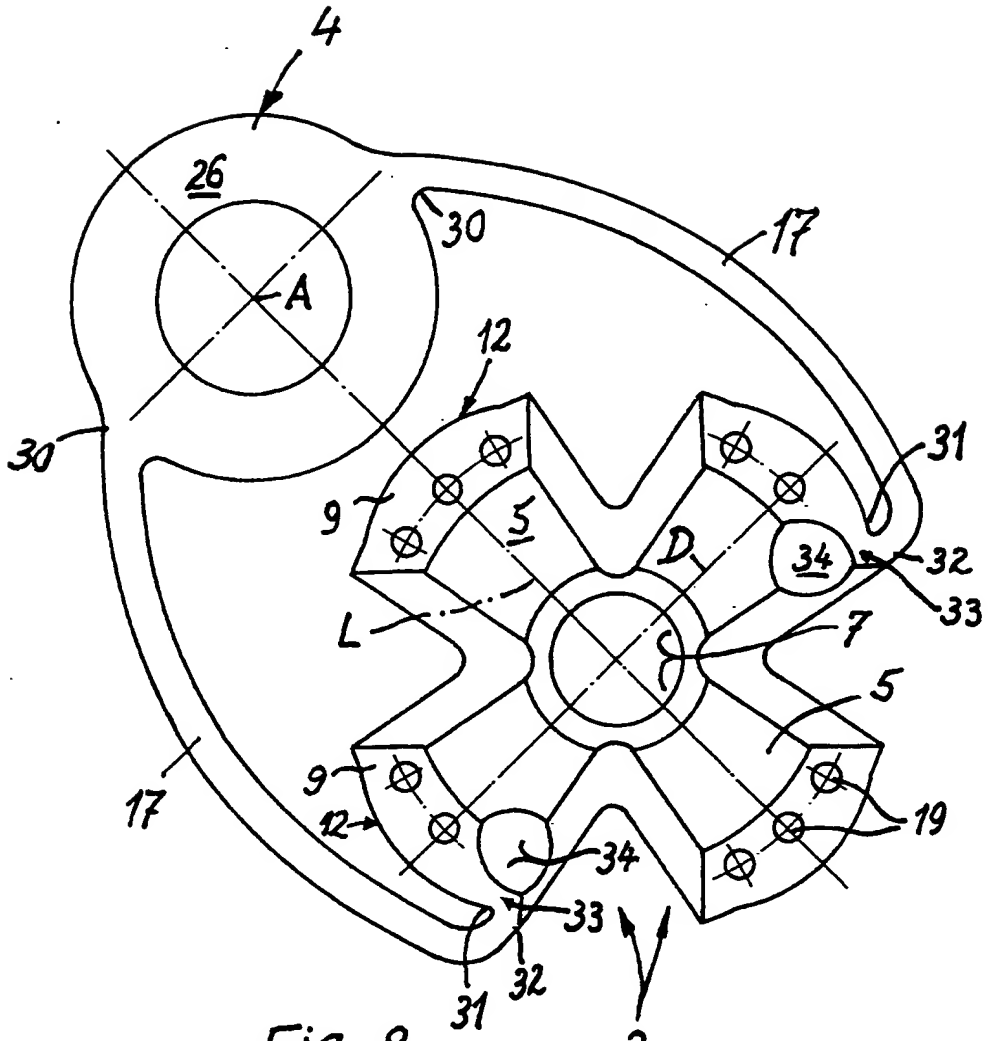


Fig. 8

SPECIFICATION

Cavity Fastening

The invention relates to a fastening element for attachment to wall elements forming at least part of a wall having cavities or suchlike places inaccessible at the rear (cavity fastening), the cavity fastening having an anchoring member engageable behind the wall element, for use with an assembly screw screwable therein.

Conventional spreader dowels are unsuitable for such wall elements having hollow spaces or cavities and may also present other fitting difficulties owing to their generally too thin walls. Tilting dowels, already known for comparable applications, which are introduced with their anchoring part through a drill hole into the cavity or suchlike inaccessible space and are anchored there by tilting or spreading have, among other things, the disadvantage that their design is expensive, they require relatively large drill holes and they are often complicated and difficult to handle.

Also, fastening elements are already known for hollow walls or the like, which have an internal thread and several finger-like spreader legs. These can spring together radially if the fastening element is introduced through a wall hole by means of an assembly screw; they spread out again in the cavity after introduction. When the assembly screw is tightened, these spreader legs are gradually brought up against the rear side of the fastening wall, for example, with considerable deformation. This can be such that the spreader legs come to rest approximately parallel to the rear side of the fastening wall. Occasionally, these spreader legs can also penetrate partly or wholly from behind into the fastening wall. A disadvantage of this fastening element is the unsupervised behaviour of these spreader legs and their elasticity which is even desirable in some respects. Also, a long screw path and, correspondingly, a long fitting time is required.

A further disadvantage of these known fastening elements is also their different behaviour towards soft and hard wall materials. With soft wall materials the wall resistance necessary for spreading, especially their hardness and stability, can under certain circumstances be insufficient, so that the spreader legs of the fastening element penetrate into the wall. The risk then arises that the edge of the hole of the fastening wall will be damaged. Here, also, virtually no definite fastening conditions are given, since the optimal fastening position – just as in the case of approximately flat tilting of the spreader legs – is at least difficult to detect, if at all, when the screw is screwed in. A disadvantage of the above-mentioned hollow wall fastening elements is also that the necessary centring in the drill hole is not possible at all or is possible only with the aid of special screws and the like.

The object of the invention is to provide a cavity fastening which is simple to make, has a comparatively high loading capacity and is simple and convenient to handle during fitting.

According to the invention, there is provided a cavity fastening for enabling a screw threaded member to be secured to a wall element inaccessible from the rear, comprising an anchoring member having a base having an aperture therein for receiving said threaded member and a plurality of supporting legs extending axially and radially outwardly of said base which are substantially rigid in the axial direction, but are flexible radially inwards, the free ends of said legs being adapted to engage the rear of said wall element.

When the cavity fastening according to the invention is introduced through a wall drill hole, the supporting legs can spring substantially radially inwards and then spread out behind the fastening wall. The supporting legs which are substantially rigid in the loading direction then rest with their bearing faces on the rear side in a definite position, virtually no change in position and deformation of the anchoring part occurring during tightening of the assembly screw. A good fastening can thereby be achieved rapidly in an advantageous way with comparatively few screw turns. The optimal fastening position can be clearly detected through the rigid supporting legs when the screw is screwed in.

Advantageously, the cross-sectional faces of all the supporting legs together form in the inserted position approximately a circular face whose outside diameter is adapted approximately to the outside diameter of the base and whose clear diameter is preferably adapted to the shank diameter of the assembly screw. The circular face lying between the outside diameter of the base and the outside diameter of the assembly screw is thereby utilised in an optimal manner for the bearing face and also for the cross-sections of the supporting legs, so that, on the one hand, a secure rest and, on the other hand, good rigidity and resistance to buckling of the supporting legs are provided.

Appropriately, the cross-section of the supporting legs is made in the form of a shell or an annular section. An approximately corrugated shaping results in large resistance to buckling of the supporting legs.

A further development of the invention provides that the cavity fastening has a centring bush corresponding in cross-section approximately to the base of the anchoring part and having a through-hole for the assembly screw. This ensures that the anchoring part comes to rest centrally, so that a favourable load distribution is then provided.

It is appropriate if the anchoring part and the centring bush have a connection preferably in the form of at least one elongate connecting member. The fastening part of the cavity fastening can thereby be introduced, as required, initially without an assembly screw, so that the part to be fastened need not be fastened to the bushing assembly and, correspondingly, also needs to have only a bore corresponding to the screw diameter. Furthermore, if required, the assembly screw can be subsequently removed without the anchoring member slipping.

Advantageously, the wire or each connecting member is fastened to a free end of a supporting leg and preferably to the marginal region, outer in the direction of insertion, of the centring bush. The con-

necting member or members have, besides the "dragging effect", also a twisting prevention function which also takes effect when the assembly screw is screwed in loosely.

In the accompanying drawings;

Figure 1 is a side view of a preferred embodiment of a cavity fastening according to the invention,

Figure 2 is a longitudinal section of an anchoring part for a cavity fastening according to the invention shown with half a side,

Figure 3 is a bottom view of the bearing faces of an anchoring member together with a centring bush,

Figure 4 is a side view of an anchoring member together with a centring bush,

Figure 5 shows an anchoring member in the inserted position with the supporting faces shown in the fastening position,

Figure 6 is a bottom view of an anchoring member in the fastening position,

Figure 7 is a side view in section of a cavity fastening according to the invention, with a wall element and a fastened panel,

Figure 8 is a view corresponding to Figure 3 of a further embodiment of a cavity fastening according to the invention in which the connection between the anchoring member and centring bush is modified.

As shown in Figure 1, a cavity fastening 1 according to the invention has an anchoring member 2 and an assembly screw 3 screwable therein. Figure 1 shows an embodiment of a cavity fastening 1 together with a centring bush 4, while Figure 6 shows an embodiment having a separate anchoring member 2.

The anchoring member 2 is made approximately in the form of a stool and has in the embodiment shown four outwardly spread supporting legs 5. The part of the anchoring member 2 adjoining the supporting legs 5 forms a common base 6 for the supporting legs 5. It has a hole 7 to receive the assembly screw 3. This hole 7 appropriately bears a preformed thread 8, especially a wood-screw thread (Figure 2).

The supporting legs 5 are made substantially rigid in the loading direction – corresponding approximately to the arrows Pf1 in Figure 4; however, they are flexible radially inwards. As will be described later, this is provided for passage through a wall hole.

Starting from the longitudinal centre axis M or a line parallel thereto, the spreading angle α of the supporting legs 5 lies in the region between approximately 15° and 20°, preferably approximately 17°. This spreading angle α has proved to be favourable in practice, since, on the one hand, it enables the supporting legs 5 to be compressed easily into the insertion position (Figure 5), yet, on the other hand, it also gives a sufficient spacing of the bearing faces 9 from the margin 10 of the wall hole 11 (see wall bearing regions marked by broken lines in Figure 5).

Since the supporting capacity or compressive strength of hollow wall elements is frequently only small, good load distribution over a large area is of importance. On the other hand, however, the wall hole 11 provided for introduction of the anchoring member 2 should be as small as possible. To achieve this, the cross-sectional faces of all the supporting legs 5 together form in the inserted position (Figure 5) approximately a circular face whose outside diameter is approximately that of the base and whose clear diameter is adapted approximately to the shank diameter of the assembly screw. The ratio of the diameter of the assembly screw 3 to the drillhole diameter (d_1/d) is approximately 1:2. To achieve large-area contact on the rear side of the wall in the functional position, the bearing faces 9 of the supporting legs 5 are directed in the functional position (e.g. Figure 1) approximately at right angles to the longitudinal centre axis M (Figure 4). Also e.g. Figures 4 and 3 show that the outer faces of the supporting legs 5 have in the spread state an outline approximately in the form of a truncated cone and have bulge 12 towards the free end 24 of the supporting legs 5, so that the bearing faces 9 of the supporting legs 5 possess, together with the widening obtained from the bulge 12, when the supporting legs 5 are in the inserted position, an approximately circular outer contour corresponding to the diameter of the base 6. Consequently, the bearing faces 9 of the supporting legs 5 are made maximal in relation to the cross section of the wall hole 11. Moreover, the bulges 12 serve to stiffen the supporting legs 5 in the manner of a corrugation. Good rigidity of all the supporting legs 5 is provided also by their cross section in the form of a shell or in the form of a circular ring section.

As already mentioned above, a preferred embodiment of a cavity fastening 1 according to the invention has a centring bush 4 corresponding in cross-section approximately to the base 6 of the anchoring member 2 and having a through-hole 25 for the assembly screw 3 (Figure 1). This centring bush 4 guarantees favourable central positioning of the anchoring member 2, the spacings between the individual supporting legs 5 and the wall hole margin 10 being approximately equal (Figure 5). Also, it serves as an inner bracing of the wall hole 11, so that crumbling is prevented. Figure 3 shows a centring bush 4 with an approximately circular cross-section. As a safeguard against twisting when the assembly screw 3 is introduced it has a twisting block 13 in the form of a profiling 14 of its outer surface. At the insertion end 15 of the centring bush 4 there is provided a chamfer 16 to facilitate introduction into the wall hole 11. A similar chamfer 16*a* is appropriately provided also on the insertion end 15*a* of the anchoring member 2 (Figure 4).

The anchoring member 2 and the centring bush 4 can have a connection preferably in the form of one or more elongate connectors 17 (Figures 1, 3, 4 and 8). This connection or connections form, among other things, an aid to fitting, by which the anchoring member 2 can be prepositioned and can also be introduced into the hollow wall without an assembly screw 3. Furthermore, the assembly screw 3 can, if required, be removed once more without the anchoring part leaving the region of the wall hole 11.

The connectors 17 can be preformed so that the initial position of the anchoring part 2 in relation to the centring bush 4 is predetermined. Here, for example, production and/or fitting factors can have decisive importance. The connector 17 can e.g. in its

initial position be curved in the plane of the bearing faces 9 of the supporting legs 5 and the plane of the outer end 26 and can be joined to the anchoring part 2 laterally on its outside face. Besides this arrangement, a multi-wire connection, as indicated in Figures 1 and 3, is also conceivable. Preforming of the connectors so that the centring bush 4 and the anchoring member are in an approximately axially aligned prefitting position can be achieved e.g. by a two-wire or alternatively three-wire connection.

In the embodiment the connectors 17 are each joined to a free end of a supporting leg 5 and preferably to the marginal region 18, outer in the direction of insertion, of the centring bush 4. The connector or connectors 17, besides the above-mentioned purpose, also have a twisting prevention and retaining function for the anchoring member 2. When the assembly screw 3 is screwed in, the connecting member 2 can be retained by the connectors at the very beginning of the fastening operation and secured against twisting.

On the outside the centring bush 4 can have one or more flattenings 27 whose number corresponds e.g. to the number of connectors 17 engaging thereon and which are approximately axially directed. A clamping effect is thereby prevented in the region where the connectors 17 are guided past the centring bush 4.

The connectors are preferably comparatively short, preferably corresponding in length approximately to twice the outside diameter of the anchoring member 2 in the inserted position (Figure 5). When the anchoring member 2 is introduced, the centring bush 4 is thereby drawn into the wall hole 11, as required, along with it.

The bearing faces 9 of the supporting legs 5 are provided with substantially conical projections 19 which serve as a turning and anchoring aid. Furthermore, however, they also improve the resistance to buckling of the supporting legs 5. There can also be provided to increase resistance to buckling – as shown in Figures 3 and 4 – junctions, particularly in the form of thin flexible membranes 21, which can be compressed and which engage on adjacent side edges 20 of the supporting legs 5. These form a spreading limitation 28 for the supporting legs 5.

To achieve different radial flexibilities of the supporting legs 5 – namely, easy engageability inwards and high spreading strength outwards – they have a cross-section which is reduced towards the region of the hinging thereof on the base 6, it being of substantial importance that the cross-section is reduced from the inside (Figure 2) so as to provide the different flexibilities.

The anchoring member 2, the centring bush 4 and the connectors 17 may be made of a plastics material and are made preferably in one piece. The cavity fastening according to the invention is thereby simple to manufacture and easy to handle.

Figure 7 shows a cavity fastening 1 according to the invention in the fitted position, a board 22 being fastened to a hollow wall element 23 by means of the assembly screw 3. In the wall hole 11 there is a centring bush 4 by which the axial position of the anchoring member 2 is determined. The centring bush 4 corresponds in its axial length approximately to the wall thickness of the hollow wall element 23. However, even with a shorter length it still fulfils its purpose. Its axial length is appropriately adapted to the usual thickness of plaster board and is preferably approximately 9 mm.

The anchoring part of the cavity fastening can be made of metal, the anchoring member 2 being made correspondingly elastic at least in the hingeing region of the supporting legs 5. However, a preferred embodiment consists in a construction of elastic plastics material. Besides the known material properties inherent in plastics, such as simplicity of manufacture and a certain elasticity, the plastics construction together with the preferred design of the supporting legs offers the advantage that the bearing faces 9 of the supporting legs can be made of large area and flat enough for the wall element which often consists of material with a low carrying capacity so that excessive pressure per unit of area must be avoided. This is important under certain circumstances especially in the region of the margin of the hole.

An important benefit of the cavity fastening according to the invention also consists in that the thickness of the wall element has no part to play. Both narrow and very wide wall elements or suchlike partitions can be bridge by a suitable choice of assembly screw without the cavity fastening according to the invention having to be adapted accordingly. From the point of view of thickness of the wall elements or partitions it is, as it were, universally applicable.

A further advantage of the cavity fastening according to the invention consists in that the anchoring member 2 and especially its supporting legs 5 are resistant to buckling and bending over their entire length, allowing for the desirable elastic pivotability of the supporting legs 5 in their hingeing region. There is thus obtained an abutment which, on the one hand, can be pushed through a drill hole and, on the other hand, forms on the rear side of the wall through which it has been pushed a stop by means of the supporting legs. This takes place with the thickness being predetermined and fixed, that is, the axial extension of the wall anchoring part. This concrete, predetermined thickness affords clear and simple fitting conditions. Also with the cavity fastening 1 according to the invention the ratio of the diameter d of the drill hole or the adapted outside diameter of the cavity fastening and the shank diameter d_1 of the associated assembly screw 3 is relatively favourable. Contributing to the above-mentioned advantages is also the resistance to buckling and this is, in turn, promoted by the fact that the free passage cross-section of the wall hole 11 is fully utilised, as shown especially in Figure 5.

Figure 8 shows an embodiment in which, as in the above-described embodiment and especially Figures 3 and 4, the anchoring member 2 and the centring bush 4 are arranged in the production state, that is, in the state where these parts come out of the mould and are arranged before their use, approximately parallel to one another and with their end sides 9 or 26, outer in the direction of insertion of the screw 3,

aligned with one another and the connectors 17 lying approximately in the plane of these end sides. This gives an especially favourable arrangement of the junction plane of a mould. The centring bush 4 and especially its centre A is arranged, in the above-mentioned production state, approximately on a central connecting line L between two opposing supporting legs 5 or on an extension of this connecting line L and the connectors 17 engage on the supporting legs 5 lying transversely thereto. The fastening points 30 of the connectros 17 on the centring bush 4 lie opposite one another on a diameter of this centring bush 4 which runs approximately parallel to the diameter line D of those supporting legs 5 on which the opposite ends of the connectors 17 engage. These conditions are illustrated primarily in Figure 8, although they also apply to Figure 3.

As a modification of the embodiment of Figure 3, however, there is provided in Figure 8 an advantageous further development which consists in that the connectors 17 are arranged on those ends 31 of the end sides or bearing faces 9 of the supporting legs 5 which are remote from the centring bush 4 in the production state. The connectors 17 are thus longer and when they are deformed they experience in the coaxial arrangement of the centring bush 4 to the anchoring member 2 a smaller deformation and warping. Restoring forces, also, are correspondingly smaller, so that fitting is facilitated.

A reduction of this bending strain and, consequently, other strains also occurring during fitting can be achieved by the fact that the hinge point 32 of the or each connector 17 or the corresponding hingeing region 33 of the supporting leg or legs 5 is made elastic. One embodiment of this feature is shown in Figure 8. On the bearing face 9 of the supporting legs 5 there is provided near the hinge point 32 of the connector 17, on the inside, remote from the actual hinge point, of the supporting leg 5, a recess 34 which reduces the width of the supporting leg in this hingeing region 33 and which almost touches the inner corner of the supporting leg 5. The form of this recess can be different from that illustrated.

In the initial position or in the production state the supporting legs 5 therefore project radially, while the connectors 17, also, project radially at their hinge points. Besides warping, this results, in these regions with the arrangement of the guide sleeve coaxially to the anchoring member, also in a certain twisting which can, however, be easily absorbed by means of the above-mentioned measures and, where necessary, by a favorable cross-section of the connectors 17. For example, a flat cross-section of the connectors 17 can be provided, as shown in Figure 4.

Advantageously, a combination of individual or several of the above-mentioned features results in a favourable manufacture of the entire cavity fastening which can be produced in one piece. Nevertheless, especially in the embodiment according to Figure 8 a slight warping of the connectors 17 for the arrangement of the centring bush in a coaxial position to the anchoring part is possible in a simple way, the connectors 17 experiencing an approximately S-shaped deformation which has, however, rather larger radii of curvature than the embodiment according to Figure 3 or enables the eccentricity of the centring bush 4 to be reduced in relation to the anchoring member 2 in the initial position. The advantage of the additional safeguard against twisting by the connectors 17 is maintained.

All and any of the features and structural details represented in the description, the claims and the drawing can be of material importance either individually or in any combination with one another.

CLAIMS

1. A cavity fastening for enabling a screw threaded member to be secured to a wall element inaccessible from the rear, comprising an anchoring member having a base having an aperture therein for receiving said threaded member and a plurality of supporting legs extending axially and radially outwardly of said base which are substantially rigid in the axial direction, but are flexible radially inwards, the free ends of said legs being adapted to engage the rear of said wall element.

2. A fastening as claimed in claim 1, wherein when said supporting legs are bent inwardly, the cross-section of the legs substantially forms an annulus, the outside diameter of which is substantially that of the base.

3. A fastening as claimed in claim 1 or 2, wherein said legs are at an angle of from 15° to 20° relative to the axis of the anchoring member.

4. A fastening as claimed in claim 3, wherein said angle is approximately 17°.

5. A fastening as claimed in any preceding claim wherein said aperture is threaded.

6. A fastening as claimed in any preceding claim, further comprising a bush having an outer cross-section corresponding substantially to that of said base and having an aperture therethrough for said threaded member.

7. A fastening as claimed in claim 6, wherein said bush and said anchoring member are connected by at least one elongate member.

8. A fastening as claimed in claim 7, wherein the or each connecting member is secured to the free end of one of said supporting legs.

9. A fastening as claimed in claim 7 or 8, wherein the or each connecting member is secured to the outer surface of said bush.

10. A fastening as claimed in claim 9, wherein part of said outer surface of said bush is circular in cross-section and said connecting member is secured to a flattened or otherwise cutaway portion of said outer surface.

11. A fastening as claimed in any of claims 7 to 10, wherein the or each connecting member has a length substantially twice the outside diameter of said base.

12. A fastening as claimed in any of claims 6 to 11, wherein the outer cross-section of said bush is shaped so as to prevent rotation of said bush in an aperture the wall element.

13. A fastening as claimed in any preceding claim, wherein the anchoring member and/or the bush are tapered at one end so as to facilitate inser-

tion thereof.

14. A fastening as claimed in any preceding claim, wherein the outer faces of said supporting legs lie substantially on the surface of a cone.

15. A fastening as claimed in claim 14, wherein said legs have a bulge on the outside towards the free end thereof.

16. A fastening as claimed in any preceding claim, wherein the bearing surfaces at the face ends of said legs adapted to engage the rear side of said wall element are substantially co-planar.

17. A fastening as claimed in claim 16, wherein said bearing surfaces have protrusions thereon adapted to prevent said anchoring member from rotating relative to said wall element.

18. A fastening as claimed in claim 17, wherein said protrusions are conical.

19. A fastening as claimed in any preceding claim, wherein the diameter of the aperture for said threaded member is substantially half that of the diameter of said base.

20. A fastening as claimed in any preceding claim, having 3, 4 or 5 supporting legs.

21. A fastening as claimed in claim 20, wherein each leg has a cross-section substantically in the form of an annular segment.

22. A fastening as claimed in any preceding claim, comprising means extending between said legs to prevent excessive separation thereof.

23. A fastening as claimed in claim 22, wherein said means comprises one or more flexible membranes, secured to adjacent sides of said supporting legs.

24. A fastening as claimed in any preceding claim made in one piece of plastics material.

25. A fastening as claimed in any preceding claim, wherein the cross-section of said legs is reduced at the roots thereof.

26. A fastening as claimed in claim 25, wherein the cross-section of said legs is reduced on the inside thereof.

27. A fastening as claimed in any of claims 6 to 26, wherein the axial length of said bush is substantially 9mm.

28. A fastening as claimed in any of claims 7 to 27, wherein, in its initial position, the bearing faces of said supporting legs and the plane of one end of said bush are coplanar with said one or more connecting members.

29. A fastening as claimed in any of claims 7 to 28, wherein the or each connecting member is curved.

30. A fastening as claimed in any preceding claim, wherein the bearing faces of said supporting legs lie in a plane normal to the axis of the anchoring member when no radical force is applied thereto.

31. A fastening as claimed in any preceding claims, wherein said supporting legs are made resistant to buckling and bending.

32. A fastening as claimed in any preceding claim, wherein the entire anchoring part is made resistant to buckling and virtually invariable in length, apart from the desirable pivotability of the supporting legs at their hinged ends.

33. A fastening as claimed in any preceding claim, wherein the anchoring member and the centring bush are arranged in the production state approximately parallel to one another and with their ends which are intended to be outer in the direction of insertion of the screw, aligned with one another and the connecting members lie approximately in the plane of these end sides.

34. A fastening as claimed in any preceding claim, wherein the centre of the bush is arranged in the production state approximately on a central connecting line between two opposing supporting legs and the connecting members engage on the supporting legs lying transversely thereto.

35. A fastening as claimed in any preceding claim, wherein the fastening points of the connecting members on the bush lie opposite one another on a diameter which runs approximately parallel to the diameter line of the supporting legs on which the opposite ends of the supporting members engage.

36. A fastening as claimed in any preceding claim, wherein the connecting members are arranged on those ends of the bearing faces of the supporting legs which are remote from the bush.

37. A fastening as claimed in any preceding claim, wherein the hinge point of the or each connecting member and/or the corresponding hinging region of the supporting leg or legs is elastic.

38. A fastening as claimed in any preceding claim, wherein on the bearing face of the supporting legs there is provided near the hinge point of the corresponding connecting member, preferably in the inside, remote from the actual hinge point, of the supporting leg, a recess which reduces the width of the supporting leg in said hinging region.

39. A cavity fastening substantially as herein described with reference to the accompanying drawings.

40. A fastening as claimed in any preceding claim, wherein the supporting legs are resilient in the radial direction, whereby the legs spread into the securing position in the absence of stresses thereon.

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